

REMARKS

This is intended as a full and complete response to the Office Action dated October 5, 2005, having a shortened statutory period for response extended one-month to expire on February 6, 2006. Claims 1-22 remain pending in the application and are shown above. Claims 1-22 are rejected by the Examiner. Reconsideration of the rejected claims is requested for reasons presented below.

Claim Rejections – 35 U.S.C. § 112

Claims 16, 17, 20, 21, and 22 are rejected under 35 U.S.C. § 112, second paragraph. Claims 16, 17, 20, 21, and 22 have been amended to clarify the subject matter of the invention. These amendments are not presented to distinguish a reference, thus, the claims as amended are entitled to a full range of equivalents if not previously amended to distinguish a reference. Withdrawal of the rejections is respectfully requested.

Claim Rejections – 35 U.S.C. § 102

Claims 1, 2, 7, 8, 9, 10, 16, 17 and 18 are rejected under 35 U.S.C. § 102(e) as being anticipated by *Rui et al* (U.S. Publ. No. 2004/0229470). The Examiner asserts that *Rui et al* discloses the subject matter as recited in claims 1, 2, 7, 8, 9, 10, 16, 17 and 18. Applicant respectfully responds to this rejection.

Rui et al discloses forming an amorphous carbon mask on an aluminum layer and then plasma etching the aluminum layer using the amorphous carbon layer. *Rui et al* is silent as to depositing an amorphous carbon layer on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10 and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source.

Thus, *Rui et al* does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon layer on the conductive material layer by a method comprising introducing into the processing

chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, etching the amorphous carbon layer to form a patterned amorphous carbon layer, and etching feature definitions in the conductive material layer corresponding to the patterned amorphous carbon layer, as recited in claim 1 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Rui et al does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon hardmask on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, depositing an anti-reflective coating on the amorphous carbon hardmask, depositing a patterned resist material on the anti-reflective coating, etching the anti-reflective coating and amorphous carbon hardmask to the conductive material layer, and etching feature definitions in the conductive material layer, as recited in claim 9 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claim Rejections – 35 U.S.C. § 103

Claims 3, 4, 5, 11, 12 and 13 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rui et al* (U.S. Publ. No. 2004/0229470) as applied to claims 1, 2 and 9, 10 above, further in view of *Liu et al* (U.S. Publ. No. 2004/0038537). The Examiner asserts that it would have been obvious at the time of the invention was made to modify the process of *Rui et al* with the processing gases of *Liu et al*. Applicant respectfully responds to this rejection.

Rui et al is described above. *Liu et al.* discloses a method of preventing or suppressing of amorphous hard mask structures to etch features in dielectric materials. *Liu et al.* is silent as to depositing an amorphous carbon layer on the conductive material layer by a method comprising introducing into the processing chamber one or

more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10 and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source.

Thus, the combination of *Rui et al* and *Liu et al*. does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon layer on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, etching the amorphous carbon layer to form a patterned amorphous carbon layer, and etching feature definitions in the conductive material layer corresponding to the patterned amorphous carbon layer, as recited in claim 1 and claims 3, 4, and 5 dependent thereon. Withdrawal of the rejection is respectfully requested.

The combination of *Rui et al* and *Liu et al*. does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon hardmask on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, depositing an anti-reflective coating on the amorphous carbon hardmask, depositing a patterned resist material on the anti-reflective coating, etching the anti-reflective coating and amorphous carbon hardmask to the conductive material layer, and etching feature definitions in the conductive material layer, as recited in claim 9 and claims 11, 12, and 13, dependent thereon. Withdrawal of the rejection is respectfully requested.

Additionally, *Rui et al* (U.S. Serial No 10/438,638, U.S. Publ. No. 2004/0229470) and the pending application 10/800,112 are commonly owned by Applied Materials, Inc. Thus, *Rui et al* is not prior art as asserted by the Examiner under U.S.C. §103(c). A statement of common ownership is submitted herewith. Withdrawal of the rejection is respectfully requested.

Claims 6 and 14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rui et al* (U.S. Publ. No. 2004/0229470) in view of *Liu et al* (U.S. Publ. No. 2004/0038537 as applied to claims 3, 4, 5 and 11, 12, 13 above, and further in view of *Lee et al* (U.S. Patent No. 6,043,167). The Examiner asserts that it would have been obvious at the time of the invention was made to modify the process of *Rui et al* and *Liu et al.* with the power application of *Lee et al.* Applicant respectfully responds to this rejection.

Rui et al and *Liu et al.* are described above. *Lee et al.* discloses depositing a fluorocarbon/silicon dioxide composite film by supplying a first source gas of fluorine and carbon and a second source gas containing silicon oxide to a dual frequency high density plasma reactor. There is no suggestion to combine the fluorocarbon/silicon oxide composite film high density plasma deposition process of *Lee et al* with processing gas of *Liu et al* and the layering process of *Rui et al*. Further, *Lee et al.* is silent as to depositing an amorphous carbon layer on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10 and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source.

Thus, the combination of *Rui et al*, *Liu et al.*, and *Lee et al* does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon layer on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, etching the amorphous carbon layer to form a patterned amorphous carbon layer, and etching feature definitions in the conductive material layer corresponding to the patterned amorphous carbon layer, as recited in claim 1 and claim 6 dependent thereon. Withdrawal of the rejection is respectfully requested.

The combination of *Rui et al*, *Liu et al.*, and *Lee et al* does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an

amorphous carbon hardmask on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, depositing an anti-reflective coating on the amorphous carbon hardmask, depositing a patterned resist material on the anti-reflective coating, etching the anti-reflective coating and amorphous carbon hardmask to the conductive material layer, and etching feature definitions in the conductive material layer, as recited in claim 9 and claim 14 dependent thereon. Withdrawal of the rejection is respectfully requested.

Additionally, *Rui et al* (U.S. Serial No 10/438,638, U.S. Publ. No. 2004/0229470) and the pending application 10/800,112 are commonly owned by Applied Materials, Inc. Thus, *Rui et al* is not prior art as asserted by the Examiner under U.S.C. §103(c). A statement of common ownership is submitted herewith. Withdrawal of the rejection is respectfully requested.

Claims 15, 19, 20 and 21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rui et al* (U.S. Publ. No. 2004/0229470) as applied to claims 1, 2, 7, 8, 9, 10, 15, 16, 17 and 18 above, in view of *Liu et al* (U.S. Publ. No. 2004/0038537) as applied to claims 3, 4, 5, 11, 12 and 13 and further in view of *Dakshina-Murthy et al* (U.S. Patent No. 6,884,733). The Examiner asserts that it would have been obvious at the time of the invention was made to modify the process of *Rui et al* and *Liu et al*. with the silicon nitride material as an ARC layer of *Dakshina-Murthy et al*. Applicant respectfully responds to this rejection.

Rui et al and *Liu et al*. are described above. *Dakshina-Murthy et al* discloses depositing an amorphous carbon mask on a doped polysilicon material, and then depositing an anti-reflective cp layer on the amorphous carbon layer. *Dakshina-Murthy et al* is silent as to depositing an amorphous carbon layer on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10 and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source.

The combination of *Rui et al*, *Liu et al*, and *Dakshina-Murthy et al* does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon hardmask on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, depositing an anti-reflective coating on the amorphous carbon hardmask, depositing a patterned resist material on the anti-reflective coating, etching the anti-reflective coating and amorphous carbon hardmask to the conductive material layer, and etching feature definitions in the conductive material layer, wherein the anti-reflective coating is a material selected from the group of silicon nitride, silicon carbide, carbon-doped silicon oxide, amorphous carbon, and combinations thereof, as recited in claim 15. Withdrawal of the rejection is respectfully requested.

The combination of *Rui et al*, *Liu et al*, and *Dakshina-Murthy et al* does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon hardmask on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, depositing an anti-reflective coating on the amorphous carbon hardmask, depositing a patterned resist material on the anti-reflective coating, etching the anti-reflective coating and amorphous carbon hardmask to the conductive material layer, and etching feature definitions in the conductive material layer, wherein the anti-reflective coating is a material selected from the group of silicon nitride, silicon carbide, carbon-doped silicon oxide, amorphous carbon, and combinations thereof, as recited in claim 19 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Additionally, *Rui et al* (U.S. Serial No 10/438,638, U.S. Publ. No. 2004/0229470) and the pending application 10/800,112 are commonly owned by Applied Materials, Inc. Thus, *Rui et al* is not prior art as asserted by the Examiner under U.S.C. §103(c). A

statement of common ownership is submitted herewith. Withdrawal of the rejection is respectfully requested.

Claim 22 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rui et al* (U.S. Publ. No. 2004/0229470) in view of *Liu et al* (U.S. Publ. No. 2004/0038537) as applied to claims 3, 4, 5 and 11, 12, 13 above, in view of *Dakshina-Murthy et al* (U.S. Patent No. 6,884,733), and further in view of *Lee et al* (U.S Patent No. 6,043,167). Applicant respectfully traverses the rejection.

The Examiner asserts that it would have been obvious at the time of the invention was made to modify the process of *Rui et al* and *Liu et al.* with the power application of *Lee et al.* and the silicon nitride material as an ARC layer of *Dakshina-Murthy et al.* Applicant respectfully responds to this rejection.

Rui et al, *Liu et al*, *Liu et al*, and *Dakshina-Murthy et al* are described above. discloses depositing an amorphous carbon mask on a doped polysilicon material, and then depositing an anti-reflective cp layer on the amorphous carbon layer.

The combination of *Rui et al*, *Liu et al*, *Liu et al*, and *Dakshina-Murthy et al* does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon hardmask on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y , wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, depositing an anti-reflective coating on the amorphous carbon hardmask, depositing a patterned resist material on the anti-reflective coating, etching the anti-reflective coating and amorphous carbon hardmask to the conductive material layer, and etching feature definitions in the conductive material layer, wherein the anti-reflective coating is a material selected from the group of silicon nitride, silicon carbide, carbon-doped silicon oxide, amorphous carbon, and combinations thereof, wherein the generating a plasma comprises applying power from a dual-frequency RF source comprises providing a first frequency range between about 10 MHz and about 30 MHz at a power range between 200 watts and 800 watts and a second frequency range between about 100 KHz and

about 500 KHz at a power range between about 1 watt and about 200 watts, as recited in claim 22. Withdrawal of the rejection is respectfully requested.

Additionally, *Rui et al* (U.S. Serial No 10/438,638, U.S. Publ. No. 2004/0229470) and the pending application 10/800,112 are commonly owned by Applied Materials, Inc. Thus, *Rui et al* is not prior art as asserted by the Examiner under U.S.C. §103(c). A statement of common ownership is submitted herewith. Withdrawal of the rejection is respectfully requested.

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show, or suggest the invention as claimed.

The secondary references made of record are noted. However, it is believed that the secondary references are no more pertinent to the Applicant's disclosure than the primary references cited in the office action. Therefore, Applicant believes that a detailed discussion of the secondary references is not necessary for a full and complete response to this office action.

Having addressed all issues set out in the office action, Applicant respectfully submits that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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